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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]****[0001]**

[Field of the Invention]This invention relates to a polypropylene resin composition, its forming process, and the bumper for cars, and more particularly, It is attached before and after vehicles etc. and related with the polypropylene resin composition which can be suitably used as a bumper for absorbing a shock and preventing damage to the body, its forming process, and the bumper for cars.

**[0002]**

[Description of the Prior Art]From the former, propylene resin is used abundantly for reasons of the outstanding molding workability, cheap material cost, etc. as an automobile bumper. However, it can fully be satisfied only with a polypropylene regin of neither rigidity nor the various performances which are demanded from a commercial scene in respect of shock resistance. For this reason, improvement in the physical performance of the resin composition produced by carrying out initial-complement addition of inorganic fillers (talc etc.) or the addition rubbers (EPM, EPDM, etc.) for the purpose of improvement in the surface rigidity of a bumper Plastic solid has been aimed at. The resin composition which comprises polypropylene resin, an inorganic material, and an adding after mixing rubber composition in this way is called "3 Element system polypropylene system material." In 3 element-system polypropylene system material, as a material excellent in shock resistance, For example, a polypropylene system polymer with (A) propylene-ethylene block copolymer to JP,10-101890,A, (B) Ethylene-butene system rubber and (C) triblock copolymer, (D) The modified polyolefin polymer which has a hydroxyl group, and (E) talc, 2.0-5.0 g/dl of limiting viscosity and the constituent in which the butene content of (B) specified MFRs 0.5-10g/10 minutes, and the particle diameter of (E) to 5 micrometers or less 25 to 35% are indicated for \*\*\*\*\* and MFRs 5-100g of (A)/10 minutes.

**[0003]**

[Problem(s) to be Solved by the Invention]. However, cost becomes high when ethylene-butene system rubber is used for the above material composition things. When it fabricates against a actual bumper, as a result of micrifying the particle diameter of rubber, the toughness of the acquired Plastic solid fell and there was a fault that the shock resistant performance as the original purpose was not obtained. Condensation of rubber might arise depending on the process condition, and shock nature might fall remarkably.

[0004]this invention is made in view of the technical problem which such conventional technology has, and comes out. The purpose is to provide the polypropylene resin composition excellent in shock resistance, its forming process, and the bumper for cars, without using a polypropylene presentation system.

[0005]

[Means for Solving the Problem]As a result of repeating research wholeheartedly that an aforementioned problem should be solved, using 3 element-system polypropylene, by having specified a position and a size (particle diameter) of a rubber composition of these, this invention person finds out that an aforementioned problem is solved, and came to complete this invention.

[0006]Namely, a polypropylene resin composition of this invention, It is a polypropylene resin composition which comprises 3 element-system polypropylene system material which comprises crystalline polypropylene resin, adding after mixing rubber, and an inorganic filler, and mean particle diameter contains ethylene propylene rubber which is 1-3 micrometers in a range from the outermost surface to 10 micrometers.

[0007]A suitable gestalt of a polypropylene resin composition of this invention, Average molecular weight by polystyrene conversion the above-mentioned crystalline polypropylene resin which is 60000-90000 50 to 70%, Average molecular weight by polystyrene conversion blends the above-mentioned ethylene propylene rubber which are 200000-300000 at 10 to 30%, and blends the above-mentioned inorganic filler by 10 to 20% of composition ratio.

[0008]A manufacturing method of a polypropylene resin composition of this invention, Are the method of fabricating the above-mentioned polypropylene resin composition, and injection pressure 7.0 - 12.0MPa, Injection molding of the hold pressure is carried out for ejection time 4.5 to 15.0 sec under conditions which set 2.5 - 6.0MPa and retention time to 5 to 20 sec, and were 200-220 \*\* in resin temperature.

[0009]A bumper for cars of this invention processes the above-mentioned polypropylene resin composition into specified shape, and covers a paint again.

[0010]

[Embodiment of the Invention]Hereafter, the polypropylene resin composition of this invention is explained in detail. Mass percentage is shown unless it mentions specially "%" in this

specification.

[0011]Like \*\*\*\*, the polypropylene resin composition of this invention comprises 3 element-system polypropylene system material which comprises crystalline polypropylene resin, adding after mixing rubber, and an inorganic filler. By being made from these, the polypropylene resin composition excellent in rigidity or endurance is obtained. Here, the particle diameter of the above-mentioned rubber in the range from the outermost surface of a polypropylene resin composition to 10 micrometers contributes to the shock resistance of this polypropylene resin composition greatly. Then, the polypropylene resin composition of this invention contains the ethylene propylene rubber (EPM) whose mean particle diameter is 1-3 micrometers in this range. From this, it becomes the polypropylene resin composition excellent in rigidity or endurance. Although the interface of rubber and polypropylene (PP) increases in less than 1 micrometer in the particle diameter of the above EPM, the particle diameter of rubber is too small to function as an elastic body but, and the shock resistance of a PP resin constituent falls. On the other hand, if particle diameter is larger than 3 micrometers, the particle diameter of rubber will become large, and the function as an elastic body will also increase, but the interface of rubber and PP becomes small, the impact absorption by interfacial peeling falls, and the shock resistance of a PP resin constituent falls.

[0012]That whose average molecular weight by polystyrene conversion is 60000-90000 as above-mentioned crystalline polypropylene (PP) resin is preferred. When using such crystalline PP resin, compatibility with rubber and shock resistance may improve. When a molecular weight is smaller than 60000, compatibility with adding after mixing rubber may fall. When a molecular weight is larger than 90000, mobility falls, sufficient shearing force may not be applied, but condensation of rubber may take place, and shock resistance may fall. It is preferred for this crystalline PP resin to be blended by 50 to 70% of composition ratio into a PP resin constituent. Out of this range, it is not preferred to be easy to produce a rigid fall and the fall of paint adhesion, and to use it as a bumper. The above "polystyrene conversion" shows the molecular weight of the sample converted from the analytical curve acquired by GPC using several sorts of polystyrene which the molecular weight understands beforehand.

[0013]That whose average molecular weight by polystyrene conversion is 200000-300000 as the above-mentioned ethylene propylene rubber (EPM) is preferred. When using such EPM, since it excels in elastic force or compatibility with PP, it is effective. If a molecular weight is smaller than 200000, the function as an elastic body will fall easily, and when a molecular weight is larger than 300000, compatibility with PP becomes low easily and both shock resistance may fall. When a molecular weight is a mentioned range, EPM may be used alone and may be used combining two or more sorts of EPM(s) from which a molecular weight differs. It is preferred for this EPM again to be blended by 10 to 30% of composition ratio. Out of this range, it is not preferred to be easy to produce the fall of a moldability and the fall of

paint adhesion, and to use it as a bumper.

[0014]It is preferred for the above-mentioned inorganic filler to blend by 10 to 20% of composition ratio. At less than 10%, rigidity may fall, and when it exceeds 20%, appearance nature may fall that it is easy to produce the flow mark, weld, etc. Typically as this inorganic filler, calcium carbonate, clay (aluminum silicate), talc, silica, diatomaceous earth, aluminum sulfate, barium sulfate, calcium sulfate, carbon black, etc. can be illustrated. These may be used alone and may be used combining two or more sorts. It can use combining suitably lightweight hollow fillers, such as glass balloons and a milt balloon, and the weight saving of the specific gravity can also be lowered and carried out. However, when fabricating a bumper by injection molding, it is desirable to use talc from the field of the appearance nature after injection molding or the dynamic physical properties of a Plastic solid.

[0015]To the PP resin constituent of this invention, in addition to an above-mentioned 3 element-system PP system material, although limitation in particular is not carried out, it can add paints, such as a plasticizer, an antioxidant of a phenol system, the Lynn system, or sulfur systems, HALS (light stabilizer), UVA (ultraviolet ray absorbent), and carbon black, if needed. However, since the paint performed when it fabricated against a bumper etc. may turn yellow remarkably when the above-mentioned antioxidant, HALS, and UVA are added in large quantities in a PP resin composition component, it is desirable to consider it as the addition of the minimum necessary according to the purpose. Using a 2 axis extruder, a Banbury mixer, a pressurized kneader, a Henschel mixer, the Brabender type kneader, DISUPA, etc. possessing a heating device, the PP resin constituent of this invention mixes the above-mentioned quality of a compound, and it can knead or stir and it can adjust it until it becomes uniform. The PP resin constituent pelletized after adjustment can be used for injection molding.

[0016]The bumper for cars of this invention is obtained by processing an above-mentioned PP resin constituent into the specified shape doubled with the anterior part or the rear of the body, and covering a paint. From this, it becomes a bumper more effective in shock resistance than the PP resin constituent which does not paint. Here, the example of representation of a coating method is explained. First, the PP resin constituent of this invention is processed into predetermined bumper shape (painting [ no ]), washing degreasing of surface oil and fat content, garbage, etc. is performed using a drainage system detergent, and for [ 10 minutes ] grade desiccation is carried out at 50-100 \*\*. Then, a chlorine-based polyolefin system primer is painted so that thickness may be set to 5-20 micrometers at the time of desiccation, and also for [ 10 minutes ] grade desiccation is carried out at 50-100 \*\*. Next, it paints so that acrylic melamine system paint may be baked and the thickness at the time of desiccation may be set to 10-20 micrometers, and it paints so that an acrylic melamine system clear coat may similarly be baked and the thickness at the time of desiccation may be set to 30-40

micrometers by the wet state at the time of the diluting solvent of a color base not volatilizing. After finish coating, after carrying out room temperature neglect for 5 to 10 minutes as set time time, in the hot air drying furnace set as 140 \*\* \*\*5 \*\*, baking is performed for 30 minutes, and the bumper for cars is obtained. As the above-mentioned paint, an acrylic melamine system paint etc. can be used conveniently, for example.

[0017]Next, the forming process of the polypropylene resin composition of this invention is explained in detail. In this forming process, a PP resin constituent is obtained [ time / 7.0 - 12.0MPa and / ejection ] in injection pressure by carrying out injection molding of the hold pressure 4.5 to 15.0 sec under the conditions which set 2.5 - 6.0MPa and retention time to 5 to 20 sec, and were 200-220 \*\* in resin temperature. In this case, it becomes possible to shorten especially ejection time and dwelling time, and a molding cycle is shortened. A shock-proof high Plastic solid is acquired without causing condensation of rubber. A desired making machine can be used by setting injection pressure to 7.0 - 12.0MPa, without receiving restriction especially on a scale of a making machine etc. On the other hand, injection pressure cannot apply moderate shearing force to rubber out of a mentioned range, but shock resistance falls. Receiving restriction especially in the size of a metallic mold, etc. is lost by setting ejection time to 4.5 to 15.0 sec. On the other hand, ejection time cannot apply moderate shearing force to rubber out of a mentioned range, but shock resistance falls. Receiving restriction by the scale of a making machine, especially the number of gates, etc. is lost by setting hold pressure to 2.5 - 6.0MPa. On the other hand, a pressure with hold pressure moderate to rubber out of a mentioned range will not be added, but appearance nature will fall. Influence which it has on the appearance of the Plastic solid (polypropylene resin composition) by retention time is made suitable by setting retention time to 5 to 20 sec again. On the other hand, a pressure with retention time moderate to rubber out of a mentioned range will not be added, but appearance nature will fall. resin temperature -- 200-220 \*\* -- it becomes possible by carrying out to mention productive efficiency. On the other hand, when resin temperature is less than 200 \*\*, the insoluble fault of PP may occur, when it exceeds 220 \*\*, condensation of rubber may take place and shock resistance may fall. Typically, about 4-kg bumper for cars can be fabricated using the injection molding machine of clamping pressure power 2500ton under injection pressure 8.5MPa, 8 sec of ejection time, hold pressure 3.2MPa, 10 sec of retention time, and conditions with a resin temperature of 200 \*\*.

[0018]

[Example]Hereafter, although an example and a comparative example explain this invention still in detail, this invention is not limited to these examples.

[0019](Example 1) 69% of crystalline polypropylene whose weight average molecular weight is 71000, After blending EPM15% with a weight average molecular weight of a 260000 and a diameter of a rubber grain of 1.5 micrometers, and talc 16% and obtaining a polypropylene

resin composition, paint and baking were carried out and the bumper for cars of this example was obtained. The process condition was made into injection pressure 10MPa, 10 sec of ejection time, hold pressure 4MPa, the retention time of 8 sec, and the resin temperature of 200 \*\*. These are shown in Table 1.

[0020](Example 2) It is considered as the diameter of a rubber grain of 1.3 micrometers, the PP weight average molecular weight 84000, the PP weight average molecular weight 84000, the rubber weight average molecular weight 250000, and rubber compounding ratio 26%, Except having considered it as injection pressure 8.5MPa, hold pressure 3.2MPa, and 10 sec of retention time on the process condition, the same operation as Example 1 was repeated, and the bumper for cars of this example was obtained.

[0021](Example 3) It was considered as the diameter of a rubber grain of 2 micrometers, the PP weight average molecular weight 78000, and the rubber weight average molecular weight 270000, and except having considered it as 13 sec of ejection time, the retention time of 5 sec, and the resin temperature of 210 \*\* on the process condition, the same operation as Example 1 was repeated, and the bumper for cars of this example was obtained.

[0022](Comparative example 1) A rubber kind EPDM, the PP weight average molecular weight 89000, 59% of PP compounding ratio, It is considered as 21% of a rubber weight-average-molecular-weight 280000, rubber compounding ratio 20%, and filler compounding ratio, Except having considered it as injection pressure 14MPa, 5 sec of ejection time, hold pressure 6MPa, the retention time of 5 sec, and the resin temperature of 220 \*\* on the process condition, the same operation as Example 1 was repeated, and the bumper for cars of this example was obtained.

[0023](Comparative example 2) The diameter of a rubber grain of 0.7 micrometer, the PP weight average molecular weight 82000, 58% of PP compounding ratio, It was considered as 21% of the rubber compounding ratio 26% and filler compounding ratio, and except having considered it as injection pressure 8.5MPa, hold pressure 3.2MPa, and 10 sec of retention time on the process condition, the same operation as Example 1 was repeated, and the bumper for cars of this example was obtained.

[0024](Comparative example 3) The diameter of a rubber grain of 2.8 micrometers, the PP weight average molecular weight 83000, 58% of PP compounding ratio, It was considered as the rubber weight average molecular weight 250000 and rubber compounding ratio 26%, and except having been referred to as injection pressure 8.5MPa, 8 sec of ejection time, and hold pressure 3.2MPa on the process condition, the same operation as Example 1 was repeated, and the bumper for cars of this example was obtained.

[0025]About the bumper for cars obtained by the <quality assessment> examples 1-3 and the comparative examples 1-3, the quality assessment was performed using the Charpy tester which was able to take a light impact examination and correlation and by which

instrumentation was carried out. The instrumentation system used the system by which load can be estimated as the amount of displacement to a fracture. The test method measured in the form fundamentally based on JIS K7111. The specimen cut down and created the bumper for cars obtained by the example and the comparative example. While checking the particle diameter by TEM, the instrumentation Charpy test estimated by computing the distortion and maximum load to a fracture. This impact test judging is shown in Table 1.

[0026]

[Table 1]

表1 実施例の配合と成形条件での衝撃試験評価結果

	実施例			比較例		
	1	2	3	1	2	3
ゴム種類	EPM	EPM	EPM	EPDM	EPM	EPDM
ゴム粒径 $\mu\text{m}$	1.5	1.3	2	1.5	0.7	2.8
PP重量平均分子量	71000	84000	78000	89000	82000	83000
PP配合比 wt%	69	58	69	59	58	58
ゴム重量平均分子量	260000	250000	270000	280000	260000	250000
ゴム配合比 wt%	15	26	15	20	26	26
無機充填材種類	タルク	タルク	タルク	タルク	タルク	タルク
充填材配合比 wt%	16	16	16	21	16	16
射出圧力 MPa	10	8.5	10	14	8.5	8.5
射出時間 sec	10	10	13	5	10	8
保持圧力 MPa	4	3.2	4	6	3.2	3.2
保持時間 sec	8	10	10	5	10	8
樹脂温度 $^{\circ}\text{C}$	200	200	210	220	200	200
衝撃試験判定	問題なし	問題なし	問題なし	実用不可	実用不可	実用不可

[0027]As shown in Table 1 and drawing 1, it turns out that the bumper for cars obtained in Examples 1-3 is excellent in shock resistance. On the other hand, since the bumper for cars obtained by the comparative examples 1-3 does not have the kind or particle diameter of rubber within the limits of this invention, it turns out that it is bad [ shock resistance ] impractical.

[0028]As mentioned above, although the preferred embodiment and the comparative example explained this invention in detail, this invention is not limited to these examples and various modification is possible for it within the limits of the gist of this invention. For example, a paint can be covered if needed at a part of both sides or the surface of a PP resin constituent, or the rear face.

[0029]

[Effect of the Invention]As explained above, according to this invention, it writes with having specified the position and size of the rubber composition of these using 3 element-system polypropylene. The polypropylene resin composition excellent in shock resistance, its forming process, and the bumper for cars can be provided without using a special polypropylene presentation system.

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[Translation done.]